Swager Safety Guide

Version V: October 2019

a publication from AWRF®

AWRF
Associated Wire Rope Fabricators

Recommended Practice and Guideline

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Swager Safety Guide

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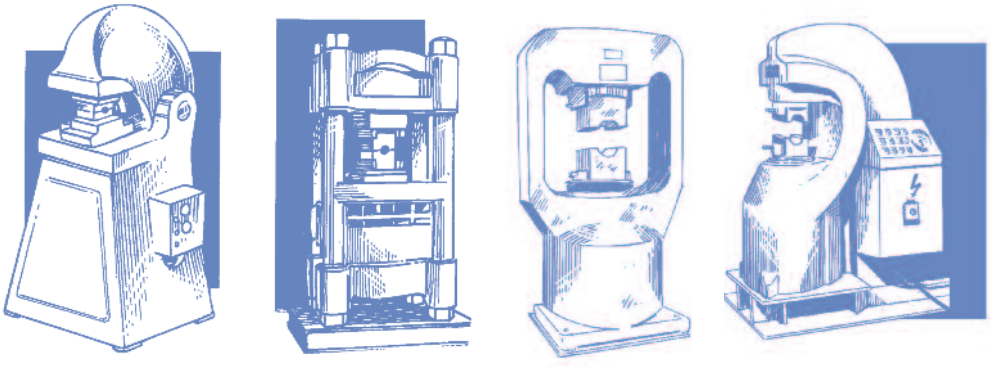
Swager Safety Guide

In any sling shop one of the most important jobs you can be asked to perform is the proper swaging of a wire rope assembly. To accomplish this, you will be using a swager which may be one of several types and sizes.

But no matter what type or size of swager you happen to be using, or how large or small the swaging job, your basic goals will always be the same:

- To make a wire rope assembly that will be safe to use.
- To make an assembly that meets required specifications.
- To work safely around the swager while it is in operation.
- To make sure all safety rules and warnings are being followed.

The machines covered by this document are specifically designed for the attachment of fittings to wire rope or strand. These slow moving swagers allow the operator full manual control of the swaging action and do not permit automatic closing. This slow movement differentiates swagers from fast moving power presses, which do NOT allow control of the ram movement.



WARNING: *Operators must be trained before operating swagers.*

To help you work safely, AWRF has prepared this brief Swager Safety Guide. As you read through the following pages, please keep in mind that we cannot possibly cover *every* situation which you may come across when using a swager in your shop. Should you ever question your safety at any time while operating or maintaining a swager, you should always:

- Talk to your supervisor or a more experienced swager operator.
- Refer to the Swager Manufacturer's Manual.
- Be aware of all swager functions including POWER OFF, and the die OPEN and die CLOSED controls.
- Refer to the Swager Warning Literature.

The point is: NEVER TAKE CHANCES WITH YOUR SAFETY, YOUR CO-WORKERS' SAFETY, VISITORS, OR THE SAFETY OF THOSE WHO DEPEND ON YOUR ASSEMBLIES AFTER THEY LEAVE THE SHOP!

It is not the purpose of this guide to give step-by-step instructions for the proper manufacture of any wire rope assembly. Before using any swager or helping a swager operator, you should become completely familiar with the recommended steps for producing the specific assembly you are making.

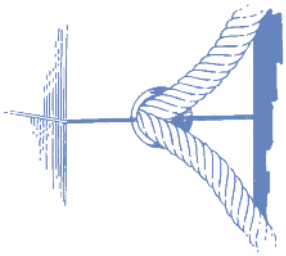
The remainder of this guide is broken into three basic sections:

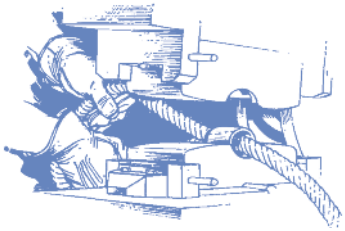
1. **General Safety Warnings:** these are safety tips which may apply to both the operation and the maintenance of the swager.
2. **Operational Safety:** this section includes safety tips for the operation of your swager.
3. **Inspection and Maintenance Safety:** this section includes safety tips which may apply when you are inspecting and maintaining your swager.

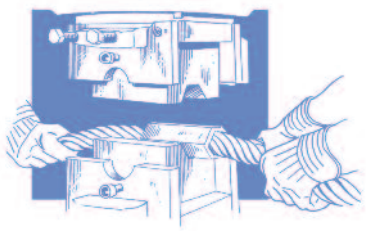
WARNING: *This guide has been prepared after careful research by the AWRF. We have tried to present the best available safety information for our members and their employees. However, we cannot be responsible for any misuse of this guide by unauthorized personnel. We cannot confirm that the opinions in this guide are identical to those held by other experts, consultants, practitioners, regulatory agencies, or safety authorities.*

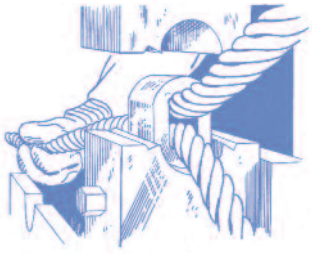
General Safety Warnings

A Swager in operation produces a tremendous amount of force. As an operator, you must always maintain a respect for this force and remind others in the shop of the safety procedures while your swager is operating. To put this in perspective, a 500 ton swager generates enough force to lift two (2) Statues of Liberty at once !









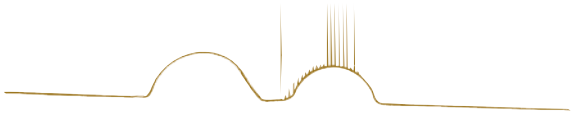
The slow operation of swagers will enable you to work safely while you carefully observe and control the entire process. But as you position your work in the dies, you should never forget the large amount of force you are using! *Always remember: to remain safe you must keep your mind focused on your work !*

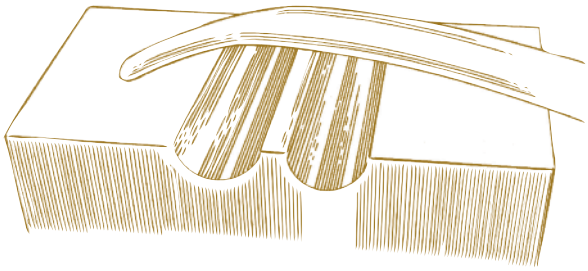
To give you complete access and an unobstructed view of the die area, swagers have no barrier guards. Experienced operators know that it would be nearly impossible to do your job properly if your access to the die area were obstructed in any way. Even transparent barrier guards, which are difficult to clean, would tend to block your view of the dies.

! The warning information and other instructions posted around your swager are there for YOUR protection and safety. Make it a habit to read and follow them. The forces you are working with can cause serious injury or death !

You should always make certain that you are swaging fittings that your swager has been designed to handle. For example:

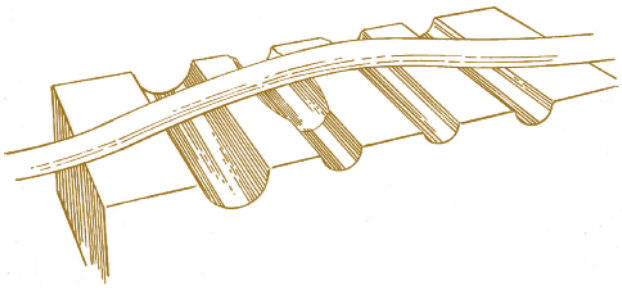
- Only use swage fittings that have been designed to be applied by swaging and are within the capacity of the swager.



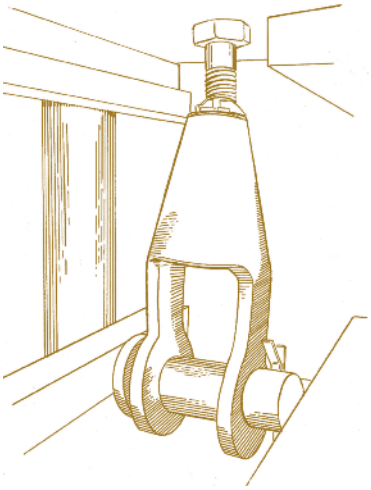


Do not try to straighten out a bent marline spike in your swager

- Never swage parts that are not designed for your dies.
- Always swage fittings of the proper design, material, and hardness.
- Never use the swager to try to form steel plate, bar stock, or anything other than the fittings designed for the swager dies.



Do not do a favor for a friend and use your swager for anything other what it is designed for; e.g. to repair a bent rod or tool.

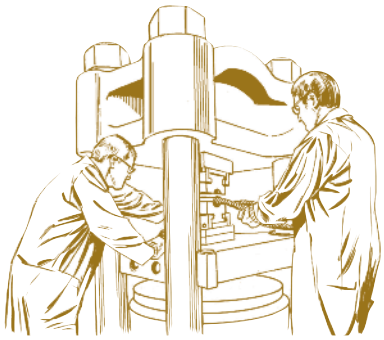


The idea of pushing out spelter cones with your swager is a recipe for disaster. Imagine if the socket is propelled out of the swager with hundreds of tons of force !

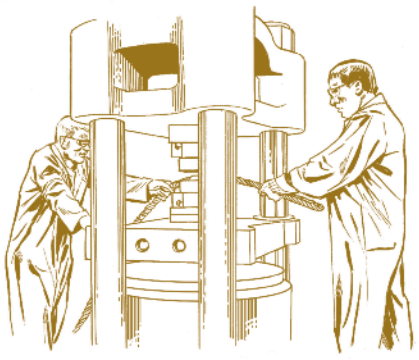
- Do not use more force/load than is required to swage a fitting. The force/load shall be set and controlled by the hydraulic/pneumatic system according to the Manufacturer's or System Designer's instruction for correct die set up.

Operator's Initials

First, you should always make certain that you are using the proper dies for the job. Then be sure to keep in mind that misused dies and die holders can break. Stay safe, keep away from the sides of your swager while it is in operation. You should also warn others not to enter the clearly marked work area while you are operating the swager.



Do NOT stand beside the swager !



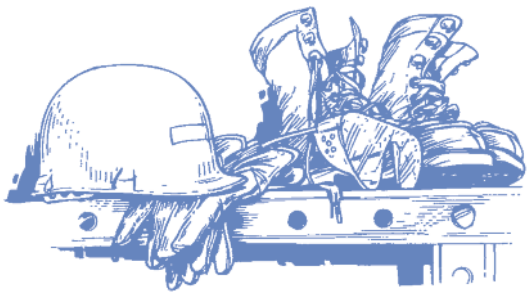
Operators should stand in front or back of the swager not beside it.

NOTE: If you are uncertain about the proper use of the dies or maximum tonnage WLL (Working Load Limit) your dies are designed for in your shop, talk to your supervisor, review your die Manufacturer's swaging manual, or contact the die Manufacturer/System Designer.

Operational Safety

No one should operate a swaging machine without proper training and authorization by his/her employer. Operating a swager safely and properly actually begins before the dies ever start to close. Some preparation steps you should take include:

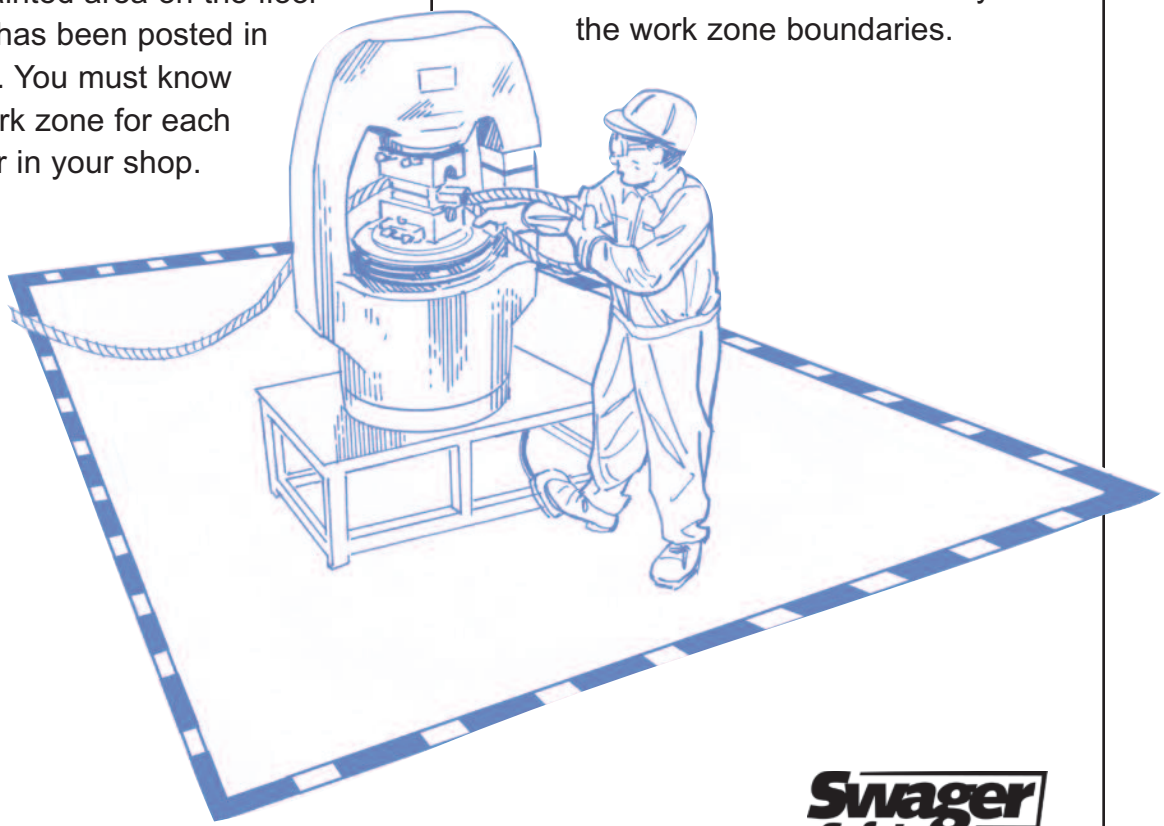
- Always make certain you are familiar with the Manufacturer's instruction manual before operating the swager. If you are in doubt about your particular job, ask your supervisor.
- Proper protective personal equipment could help you avoid a serious accident. Always wear safety glasses, gloves, and safety shoes when operating the swager.
- If you detect any malfunction IMMEDIATELY turn off the swager and report to your supervisor.



The Swager Work Zone:

There must be a clearly marked work zone around your swager. This marked zone is to keep unauthorized and untrained people clear of an operating swager. These boundaries must be maintained so they can be easily seen. As the operator it is your responsibility to:

- Know the *exact* boundaries of the work zone. This zone's limits must be clearly marked and maintained. The work zone in your shop is described at this booklet's end.
- Remember, boundaries can be marked by a wall, a fence, a rail, or a painted area on the floor which has been posted in writing. You must know the work zone for each swager in your shop.
- The swager work zone is larger for larger swagers.
- Before you begin swaging, make certain only trained swager operators or helpers are inside the zone.
- If an unauthorized employee enters the zone while you are operating the swager, *stop swaging and warn them to stay away. But do not allow them to take your attention away from the job you are doing!*
- If the floor in your shop is slippery, the swager zone may be treated with a nonskid material. This treated area can identify the work zone boundaries.



Operator's Initials

Checking the dies and die holder/die adapters.

The parts subject to the greatest forces during a swaging operation are usually the dies and the die holders. For this reason, only trained and qualified personnel should be allowed to check these prior to operating the swager. Some things to check here include:

- Never use dies above Working Load Limit (WLL). Dies used above WLL can be dangerous. Do not use more force/load than is required to swage a fitting.

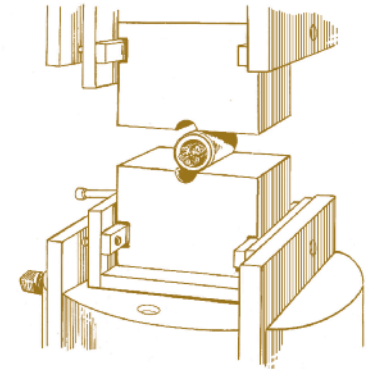
WARNING: *When using dies with lower WLL than the swager capacity, you must adjust the swager's settings so that the force generated is no greater than the WLL of the dies being used. Failure to do this can cause serious injury or death. Contact Manufacturer for instructions for tonnage adjustment!*

- Damaged dies can be dangerous! Inspect your dies and never use any dies that are cracked, worn, or abraded (galled).

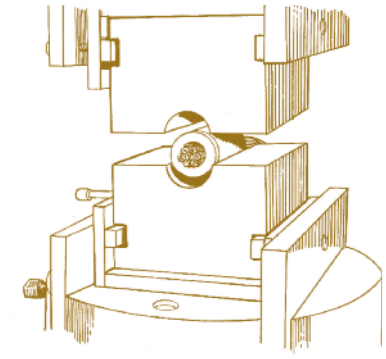
WARNING: *Damaged dies can cause serious injury or death!*

- Only use the proper size die. You, the operator, are responsible for making sure the dies, the rope, and the fittings match. Check Manufacturer's information and die recommendation before swaging.

WARNING: *Mismatched dies and fittings can be dangerous, causing serious injury or death!*



This die is too small for the fitting size.



Matched die and fitting size

WARNING: *Ejected material can cause serious injury or death!*

- Always use a matched set of dies. Never mix die halves.

⚠ *WARNING:* *Mismatched dies can apply extreme forces causing a safety hazard, including serious injury or death!*

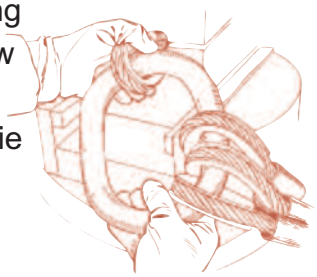
- Always make certain that the dies are clear of any foreign matter before you begin swaging. This will keep foreign matter from being ejected during the swaging operation.
- Never shim between the mating surfaces of dies to achieve the required after-swage dimension.
- Always make sure die holders are in good condition with all bolts and retainers properly tightened and side plate and guard rails in place and not bent or loose. Check to ensure all holder surfaces are undamaged and dies move freely in and out of holder. Damaged die holder surfaces that are not flat and parallel can cause excessive loads on dies. Check die holder surfaces with straight edge to ensure they are straight and parallel, and perpendicular to each other.

⚠ *WARNING:* *Damaged or worn die holders can cause serious injury or death!*

Keeping a clear view of your work.

As has already been pointed out, an unobstructed view of the swager dies is crucial to the production of a wire rope assembly which will perform to its specifications in the field. Some areas to watch here include:

- Allow nothing to obstruct or block your view, or your co-workers' view, of the die closing area.
- You may be moving the assembly several times during the operation. Allow sufficient handling room around the die and swage area.

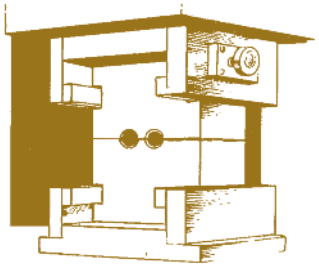


⚠ *WARNING:* *Never put your hands into the die area during the swage operation!*

- If your swager uses foot controls, make certain they are unobstructed and guarded.
- When manipulating wire rope assemblies in and out of the swaging area, be careful not to damage hydraulic hoses, gauges, guide bushings, tie rods, or electronics.
- Maintain adequate lighting in the swager working area.
- Avoid distractions.

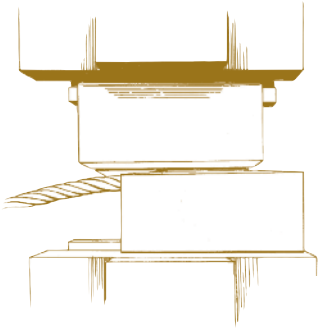
Setting up your dies.

> ***WARNING:*** *Only trained and authorized personnel should set up and operate your swaging machines.*

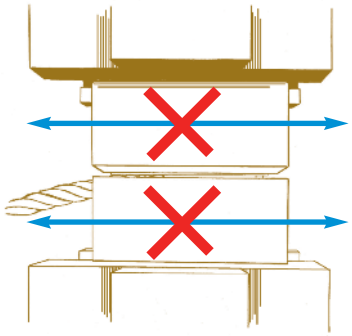


- Some swager types have a 'floating' die system. 'Floating' die systems allow the dies to self align and center over fittings that are round prior to swaging.

- When setting up your dies, regardless of 'Floating' or 'Fixed' systems, the dies must be installed in a die holder so the dies align lengthwise and are retained using manufacturers recommendations.

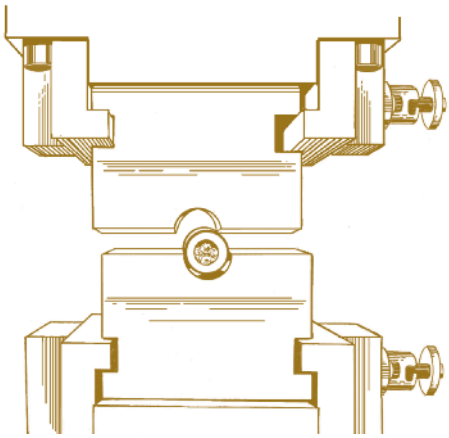


These dies are NOT installed properly. The length of the dies must fit each other.

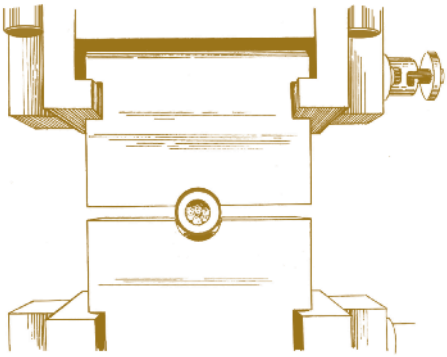


These dies ARE properly installed. NO free movement is allowed in the direction of the arrows.

- *When swaging round steel fittings with such "floating" die systems, do not shim dies.*

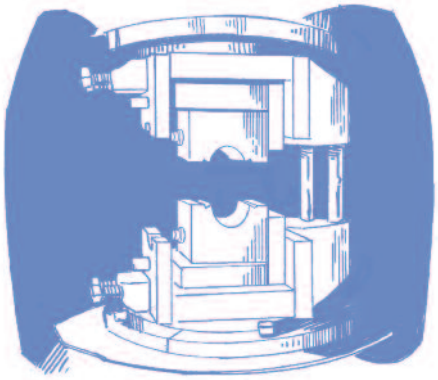


Dies for round steel fittings must be free to float sideways to align on top of each other.

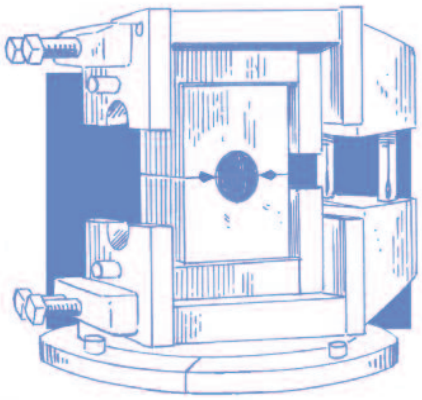


In the above picture the dies now have aligned and centered themselves over the round fitting to be swaged.

- If you operate swagers with a 'fixed' die system consult the Manufacturer or System Designer.

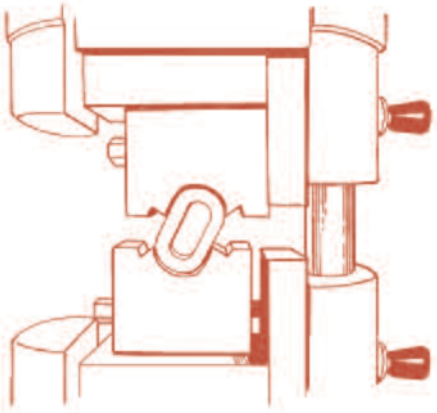


The pictures above and below show a typical 'fixed' die system.

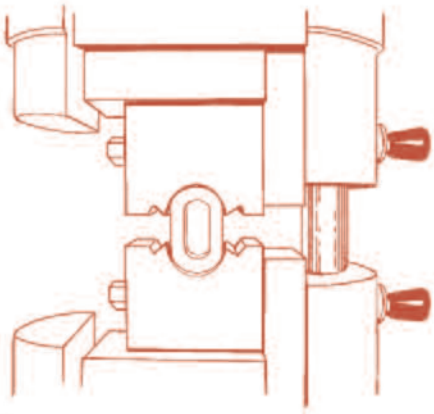


- 'Fixed' die systems are aligned and centered prior to swaging and do **NOT** allow the dies to self align nor center during swaging.

- If a "fixed" die system is used to swage round and oval sleeves, the dies must be properly aligned, centered and retained using the manufacturers recommendations.



These dies are NOT properly aligned, centered, nor fixed into place.

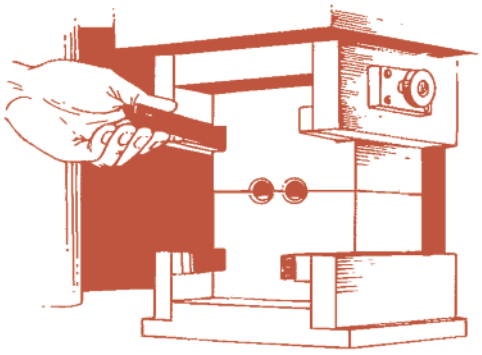


These dies are properly aligned and centered to swage an oval fitting. BOTH dies are firmly fixed in place to prevent any sideways and lengthwise movement.

Operator's Initials

- When swaging oval aluminum or oval steel fittings, use the Manufacturer's or System Designer's recommended dies and follow their procedures.

- "Floating" die systems can be used to swage oval fittings if the swager is suitable for it, and ONLY if the dies are firmly fixed into place to prevent any movement during the swage.
  Your dies may need shimming if they do not align on top of each other.

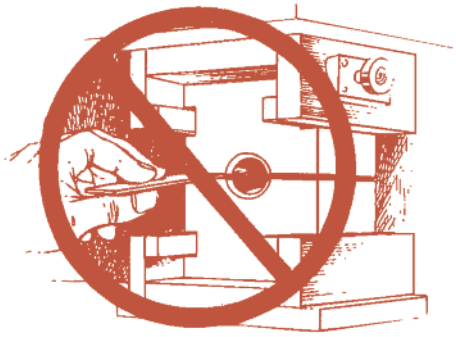


When using a swager that has a 'floating' die system, the dies may need to be shimmed to swage oval fittings.

- If you operate swagers with a 'fixed' die system such dies must NOT be shimmed.

For either the "Floating" or "Fixed" system, make sure that the manufacturer's die retention locking pin, bolt or other device is engaged and has secured the die before swaging. Additionally, make sure that the dies are straight, parallel, and perpendicular to each other before AND during the swaging procedure.

Preparing the swager



WARNING: *NEVER shim between dies. This can cause serious injury or death* !

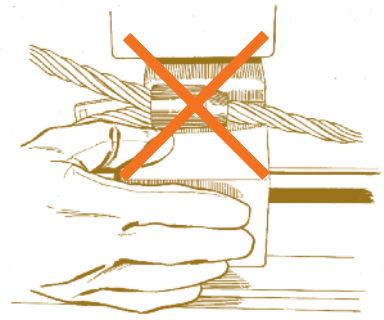
- Make sure the swager is in good operating condition and that all gauges, indicators and controls are working properly.
- Use the proper capacity swager for the fitting.
- Adjust the swager hydraulic pressure so that it does not exceed the WLL for the dies selected, and does not use more pressure than is required to swage the fitting.
- Make certain you are using the correct die for the size and type of wire rope fitting.
- Maintain clean and lubricated die faces and cavities. Lubricate with light oil or high pressure grease as specified by the manufacturer or system designer.

During the swaging operation.

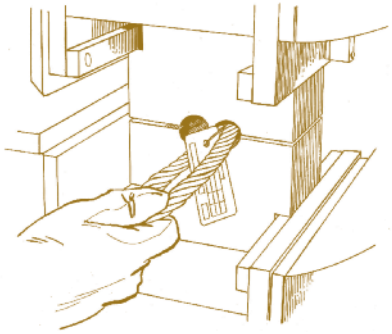
⚠ *WARNING:* *Only trained and authorized personnel should operate the swager.*

- Always keep in mind that moving swager and die parts can form traps or pinch points during operation
- Observe the die closure from above and slightly to the side. Do not look directly into the die area during swaging. The best position is to stand 45 degrees to either side of the die front.
- Progressively swage fittings only in open channel dies. Progressive swaging is done due to die Working Load Limit or swager tonnage limitations. If in doubt, ask your supervisor or die manufacturer.
- Do not use more pressure than is required to swage the fitting.
- Verify that the fitting is swaged to the recommended after-swage dimensions.
- Never put your hands into the die area when the swager is operating.

⚠ *WARNING:* *Improper use of a swager can result in serious injury or death !*



Keep your hands clear of the die during the swage operation



To manipulate the rope fitting during the swaging process grip the rope or fitting a safe distance away from the dies.

- Never put anything between the dies except the rope and fittings designed for use with the swager and dies.
- Reduce shop distractions, such as loud music, when operating the swager.
- Never operate a swager while under the influence of drugs, alcohol or any other limiting physical conditions.
- *Take these warnings seriously!*

Operator's Initials

Inspection and maintenance safety.

A safe swaging operation depends on the routine and careful inspection and preventative maintenance of your swager and its parts. If early signs of wear are found, you should take immediate steps to ensure that the machine continues to run smoothly and produce quality assemblies which will perform to specification in the field.

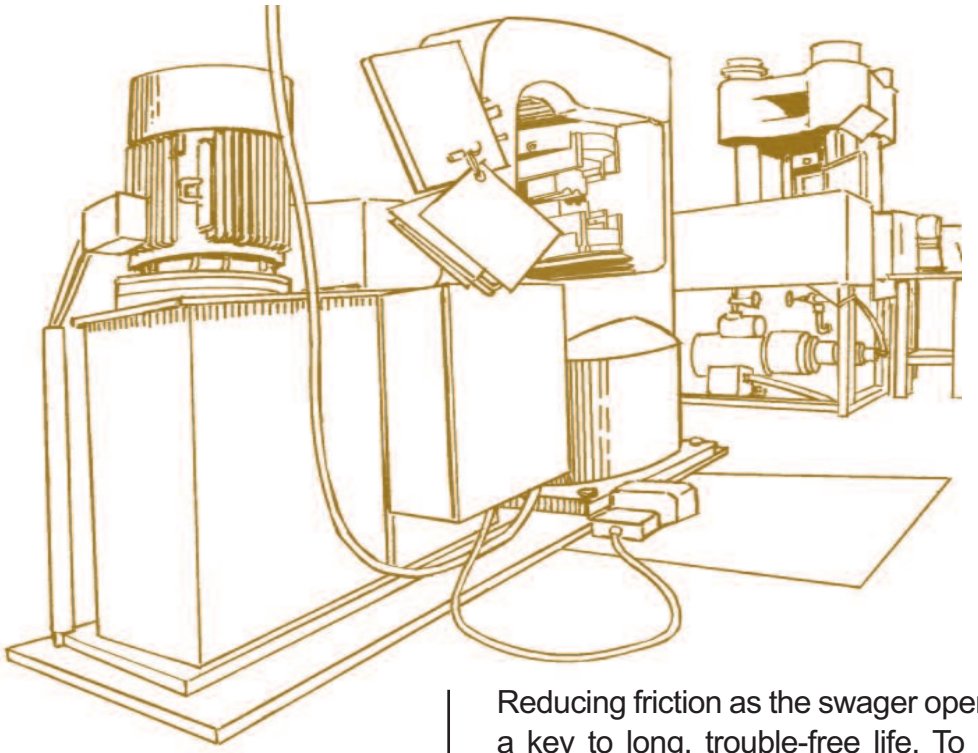
To safely inspect or maintain your swager you should always follow any lockout/tagout procedures your shop uses to prevent accidental and possibly dangerous unexpected start-up. These procedures must disable not only the electrical but also the hydraulic systems.

NOTE: The variety of swagers and their supporting systems makes it impossible to provide specific lockout steps for your particular operations.

***WARNING:** If you have doubts, ask your supervisor for instructions or for written lockout/tagout procedures for your shop as required by OSHA or other responsible regulatory or safety agencies.*

Once you have safely disabled the swager, some inspection and maintenance steps to perform often include:

- Make sure all nuts and bolts, clamps, hydraulic hoses and their fittings are in place and tightened to the torque as specified by the Manufacturer or System Designer.
- Make sure your die holder is not damaged and all bolts and nuts are in place and tightened to the recommended torque.
- Load block or die base plate surfaces must be to Manufacturer's specifications for thickness as well as flatness, and should be parallel to provide complete support of the top and bottom die during swaging.
- Make certain that the hydraulic reservoir is full when the swager is in full open position.



- The die mating surfaces should be flat, smooth and free from any cracks or galling.
- Make sure the die holder side rails and guide rails are not bent, loose, or damaged.
- Keep dies and die holder surfaces clean. They should be free of metal shavings, slag, grit, and sand. This will reduce the chance of premature die failure.
- Make sure dies fit in and out freely.

Reducing friction as the swager operates is a key to long, trouble-free life. To do this you should:

- Lubricate all guide bushings on a daily basis as specified by the Manufacturer or System Designer.
- Inspect the tie rods for corrosion. Use a #000 emery cloth or steel wool to maintain a high polish on the surface.
- Lubricate all grease fittings as specified by the Manufacturer or System Designer.
- If so equipped, make sure the lubrication system is functioning properly.
- Inspect the piston guides or similar functions. Worn out guides/piston guide rings/hinges may add additional stresses to dies resulting in die cracking or die fatigue.

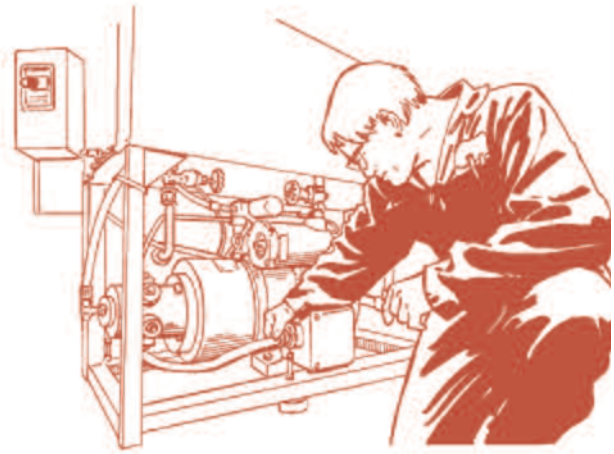
Maintaining the hydraulic system.

The great forces used in a swager are achieved using hydraulic pressure. Inspecting and maintaining this vital system on a regular basis can help assure that you will be operating to the Manufacturer's specifications. Some safety points here include:

- Never increase the hydraulic system pressure above the level preset by the Manufacturer.

> ⚠ ***WARNING:*** *Adjusting pressure above the Manufacturer's recommended pressures could cause serious injury or death!*

- Under ordinary conditions, you should drain and clean the reservoir every two (2) years and refill with new hydraulic oil as specified by the Manufacturer or System Designer.



- Filters inside the reservoir should be cleaned or replaced every time the reservoir is drained and cleaned as specified by the Manufacturer or System Designer.
- The suction filter should be cleaned every six (6) months under normal conditions as specified by the Manufacturer or System Designer.
- Swagers are designed to operate with extremely high oil pressures. Inspect all hydraulic fittings and hoses for cracks and leaks. Any cracked hose or damaged fitting shall be replaced immediately.

Conclusion

This guide is only intended to give the most basic safety considerations which apply to a wide variety of swagers performing normal operations.

IT SHOULD NOT BE USED IN PLACE OF ANY SAFETY GUIDES, WARNING DECALS, OR OTHER SAFETY MATERIALS WHICH MAY HAVE BEEN SUPPLIED BY THE SWAGER MANUFACTURER OR SYSTEM DESIGNER!

Should you have any further safety questions or special applications which might call for additional safety measures, please contact:

- Your employer or shop supervisor.
- The Manufacturer or System Designer of the swager, dies, or fittings.

The following applies at

_____

(name of Slingshop)

The boundaries of the swager work zone(s) are clearly marked in our shop by (check one or more):

- ❑ Lines on the floor
- ❑ Walls
- ❑ Fences/Barriers
- ❑ Non-skid material
- ❑ Other (specify)

_____

_____

As a swager operator in our shop, you should be aware that:

_____

_____

_____

_____

I herewith declare that I will not operate a swager without being properly trained in the operation of each swager at _____

Name of Slingshop

_____	_____	_____
Name	Date	Signature

U.S. Department of Labor

Occupational Safety and Health Administration
Washington, D.C. 20210

AUG 23 2007

Reply to the attention of:

DEP/GIE/SW-10626

Mr. J. Barry Epperson
Epperson & Johnsen
Suite 501
201 West Fifth
Tulsa, OK 74103-4277

Dear Mr. Epperson:

Thank you for your October 4, 2006 and December 20, 2006 letters to the Occupational Safety and Health Administration's (OSHA's) Directorate of Enforcement Programs. Your letters requested OSHA to consider using a September 6, 1991 OSHA memorandum from Linda Anku to Area Director Thomas Pope, as a basis for national policy on the need for guarding swaging machines. This memorandum described procedures that OSHA would consider to meet the intent of §1910.212(a)(3)(iii) on swaging machines where ability to provide point of operation guarding is infeasible. This letter constitutes OSHA's interpretation only of the requirements discussed and may not be applicable to any questions not delineated within your original correspondence.

OSHA's standard at 29 CFR 1910.212 addresses *General requirements for all machines*. Section 1910.212(a)(3)(ii) provides:

> "The point of operation of machines whose operation exposes an employee to injury, shall be guarded. The guarding device shall be in conformity with any appropriate standards there for, or, in the absence of applicable specific standards, shall be so designed and constructed as to prevent the operator from having any part of his body in the danger zone during the operating cycle."

The Agency understands that the swaging operation at issue involves swaging during the manufacture of wire rope slings, and this response letter only addresses issues related to this type of operation. In these swaging operations, the operator sometimes must bend the wire rope and hold it in place while the swager operates, potentially exposing the operator's hands or fingers to crushing or amputation. OSHA also understands that guarding may not be possible for some operations using smaller gauge wire rope.

OSHA agrees that there may be some swaging machines that cannot be guarded at the point of operation. However, those situations must be determined on a case-by-case basis with the burden on the employer to

demonstrate infeasibility of complying with §1910.212.[1] Accordingly, OSHA is not able to issue a national policy based on the language in the September 6, 1991 memorandum.

Thank you for your interest in occupational safety and health. We hope you find this information helpful. OSHA requirements are set by statute, standards, and regulations. Our interpretation letters explain these requirements and how they apply to particular circumstances, but they cannot create additional employer obligations. This letter constitutes OSHA's interpretation of the requirements discussed. Note that our enforcement guidance may be affected by changes to OSHA rules. Also, from time to time we update our guidance in response to new information. To keep apprised of such developments, you can consult OSHA's website at http://www.osha.gov. If you have any further questions, please feel free to contact the Office of General Industry Enforcement at (202) 693-1850.

Sincerely,

Richard E. Fairfax

Richard E. Fairfax, Director
Directorate of Enforcement Programs

Enclosure

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[1] In the 1991 OSHA memorandum from Linda Anku, Regional Administrator, to Area Director Thomas Pope, OSHA stated that providing point of operation guards on the swaging machines that were examined was infeasible. That determination of infeasibility was made for the specific machines examined by OSHA staff during the site visit described in the memorandum.

Printed in the USA 2019